OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **DUTCHMAN POND** the program coordinators recommend the following actions. *Congratulations on continuing the more extensive sampling program! Collecting one sample during each summer month establishes a more complete data set and makes interpreting the data easier.*

FIGURE INTERPRETATION

- Figure 1: These graphs illustrate concentrations of chlorophyll-a in the water column. Algae are microscopic plants that are a natural part of lake ecosystems. Algae contain chlorophyll-a, a pigment necessary for photosynthesis. A measure of chlorophyll-a can indicate the abundance of algae in a lake. The historical data (the bottom graph) shows a *very stable* in-lake chlorophyll-a trend. Chlorophyll-a concentrations in the lake have remained well below the average for New Hampshire lakes for over a decade. While algae are present in all lakes, an excess amount of any type is not welcomed. Concentrations can increase when there are external and internal sources of phosphorus, which is the nutrient algae depend upon for growth. It's important to continue the education process and keep residents aware of the sources of phosphorus and how it influences lake quality.

- Figure 2: Water clarity is measured by using a Secchi disk. Clarity, or transparency, can be influenced by such things as algae, sediments from erosion, and natural colors of the water. The graphs on this page show historical and current year data. The lower graph shows a *very stable* trend in lake transparency. The Secchi disk was visible on the bottom of the lake all season. Values remain below the state mean reference line, but we can only wonder if they would exceed the line if the pond were deeper. The 2000 sampling season was considered to be wet and, therefore, average transparency readings are expected to be slightly lower than last year's readings. Higher amounts of rainfall usually cause more eroding of sediments into the lake and streams, thus decreasing clarity.

- Figure 3: These figures show the amounts of phosphorus in the epilimnion (the upper layer in the lake) and the hypolimnion (the lower layer); the inset graphs show current year data. Phosphorus is the limiting nutrient for plants and algae in New Hampshire waters.

Too much phosphorus in a lake can lead to increases in plant growth over time. These graphs show a *stabilizing* trend for in-lake phosphorus levels. In the early years of VLAP sampling, phosphorus concentrations were highly variable, mostly because only one sample was collected each summer. The higher phosphorous concentration in August may have been caused by sediment contamination of the sample. Mean phosphorus concentrations remain below the state median. One of the most important approaches to reducing phosphorus levels is educating the public. Humans introduce phosphorus to lakes by several means: fertilizing lawns, septic system failures, and detergents containing phosphates are just a few. Keeping the public aware of ways to reduce the input of phosphorus to lakes means less productivity in the lake. Contact the VLAP coordinator for tips on educating your lake residents or for ideas on testing your watershed for phosphorus inputs.

OTHER COMMENTS

- Small amounts of the blue-green alga *Anabaena* were collected in the plankton haul in July (Table 2). Blue-green algae can reach nuisance levels when sufficient nutrients and favorable environmental conditions are present. This pond is very shallow and, as the transparency values indicate, light can penetrate to the bottom.

- To save time and money, we suggest the samples collected in the deepest spot of the lake be reduced to one sample. Since the pond is less than 3-meters deep, one sample should suffice. A 1.5-meter sample would be just about in the middle of the water column, so we suggest using this depth in the future.

- Dissolved oxygen was high at all depths of the pond (Table 9). Shallow ponds tend to continuously mix by wind and wave action, thereby allowing for oxygen exchange with the atmosphere.

- *E. coli* originates in the intestines of warm-blooded animals (including humans) and is an indicator of associated and potentially harmful pathogens. Bacteria concentrations were low at the site tested (Table 12). If residents are concerned about septic system impacts, testing when the water table is high or after rains is best. Please consult the Other Monitoring Parameters section of the report for the current standards for *E. coli* in surface waters.

NOTES

- Monitor's Note (6/18/00): Has been raining often. 3-4 Sunny days this month. Air temperature has been colder in May and June.

USEFUL RESOURCES

Wetlands: More Important Than You Think, NHDES Booklet, (603) 271-3503 or www.state.nh.us

Bacteria in Surface Waters, *WD-BB-14*, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

A Brief History of Lakes, NH Lakes Association pamphlet, (603) 226-0299 or www.nhlakes.org

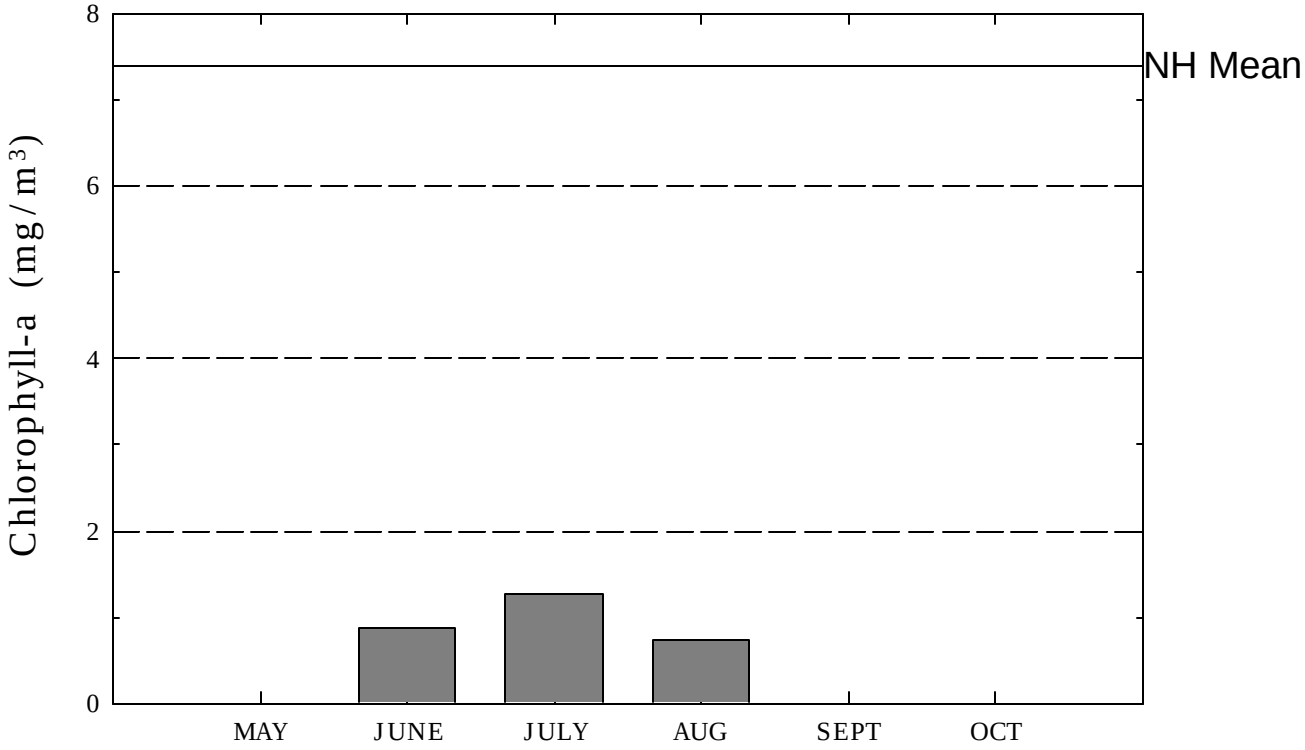
Lake Protection Tips: Some Do's and Don'ts for Maintaining Healthy Lakes, *WD-BB-9*, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

Anthropogenic Phosphorus and New Hampshire Waterbodies, NHDES-WSPCD-95-6, NHDES Booklet, (603) 271-3503

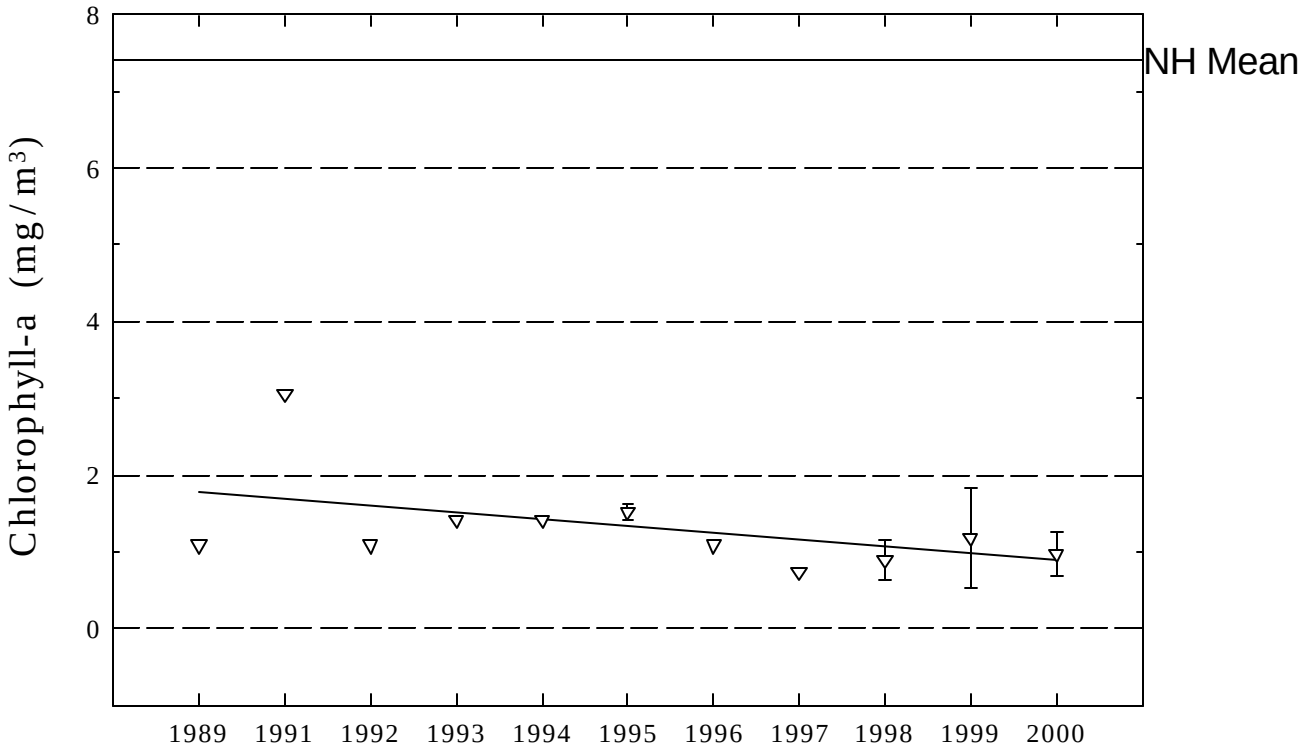
Aquatic Plants and Their Role in Lake Ecology, WD-BB-44, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

Dutchman Pond

Figure 1. Monthly and Historical Chlorophyll-a Results



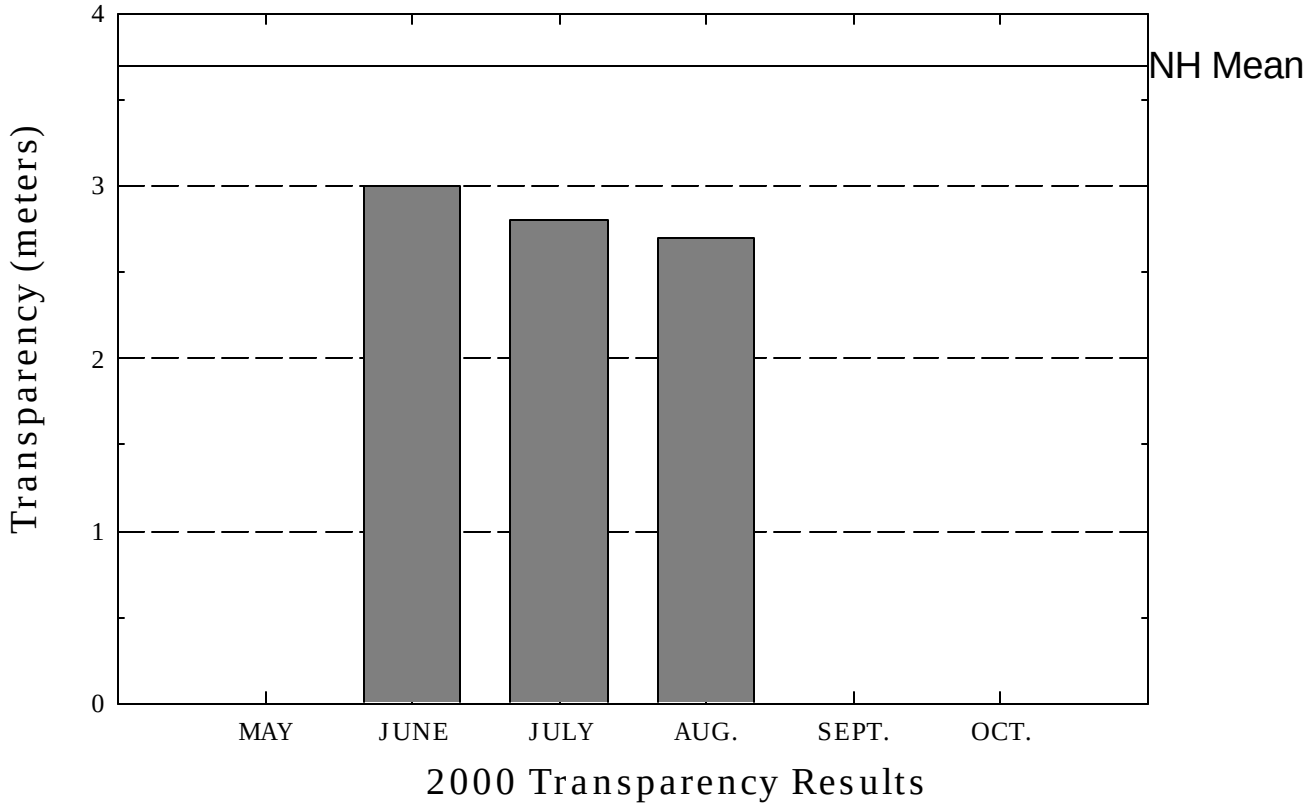
2000 Chlorophyll-a Results

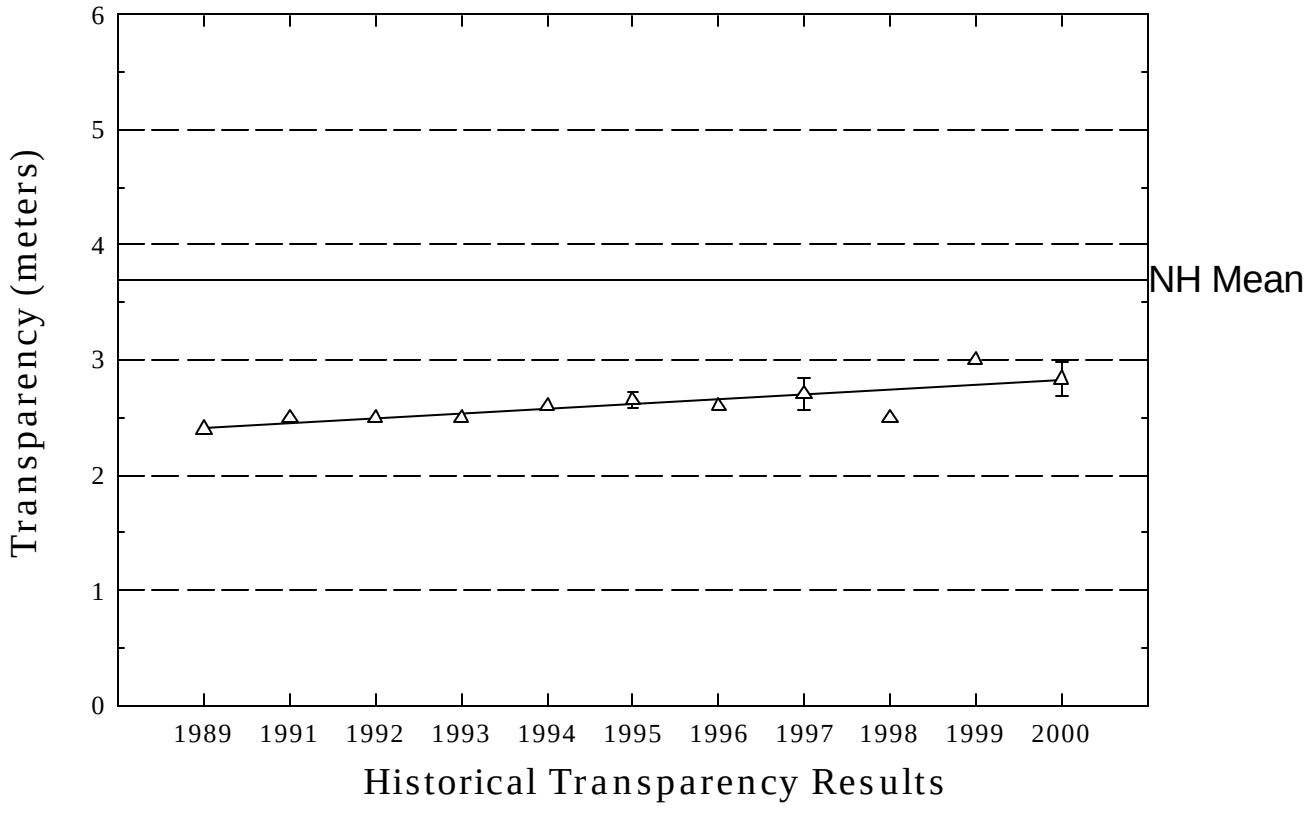


Historical Chlorophyll-a Results

Dutchman Pond

Figure 2. Monthly and Historical Transparency Results





Dutchman Pond

Figure 3. Monthly and Historical Total Phosphorus Data.

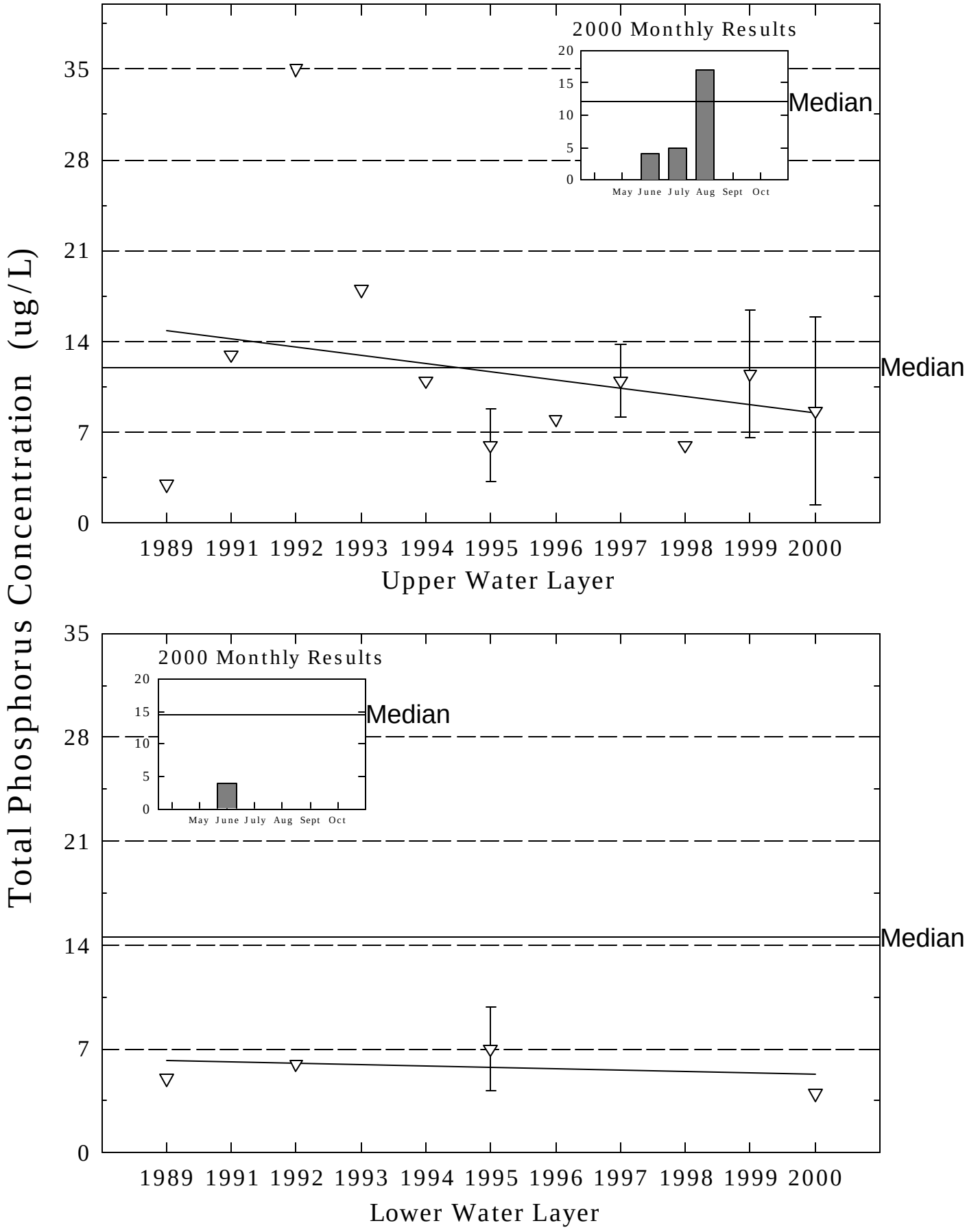


Table 1.

DUTCHMAN POND

SPRINGFIELD

Chlorophyll-a results (mg/m^3) for current year and historical sampling periods.

Year	Minimum	Maximum	Mean
1989	1.09	1.09	1.09
1991	3.06	3.06	3.06
1992	1.09	1.09	1.09
1993	1.42	1.42	1.42
1994	1.42	1.42	1.42
1995	1.45	1.59	1.52
1996	1.09	1.09	1.09
1997	0.73	0.73	0.73
1998	0.71	1.07	0.89
1999	0.71	1.64	1.17
2000	0.73	1.28	0.96

Table 2.

DUTCHMAN POND

SPRINGFIELD

Phytoplankton species and relative percent abundance.

Summary for current and historical sampling seasons.

Date of Sample	Species Observed	Relative % Abundance
07 / 18 / 1989	DINOBRYON	70
	ANABAENA	10
	OSCILLATORIA	10
07 / 11 / 1991	OSCILLATORIA	82
	MERISMOPEDIA	9
	GLEOCAPSA	3
07 / 07 / 1992	TABELLARIA	28
	STAURASTRUM	14
	ASTERIONELLA	7
06 / 10 / 1993	ANABAENA	63
06 / 09 / 1994	ANABAENA	75
	MOUGEOTIA	19
07 / 27 / 1995	SPHAEROCYSTIS	74
	GLOEOCYSTIS	13
	COELOSPHAERIUM	5
08 / 07 / 1996	SYNEDRA	70
	PERIDINIUM	7
	TABELLARIA	6
08 / 28 / 1997	PENNATE DIATOMS	27
	XANTHIDIUM	14
	ANABAENA	14
08 / 12 / 1998	SPAEROCYSTIS	39
	MICROCYSTIS	33
	KIRCHNERIELLA	11
06 / 30 / 1999	COSMARIUM	37
	GLOEOCYSTIS	19
	ANABAENA	14
07 / 12 / 2000	SPHAEROCYSTIS	55
	ELAKATOTHRIX	18
	ANABAENA	16

Table 3.

DUTCHMAN POND

SPRINGFIELD

Summary of current and historical Secchi Disk transparency results (in meters).

Year	Minimum	Maximum	Mean
1989	2.4	2.4	2.4
1991	2.5	2.5	2.5
1992	2.5	2.5	2.5
1993	2.5	2.5	2.5
1994	2.6	2.6	2.6
1995	2.6	2.7	2.6
1996	2.6	2.6	2.6
1997	2.6	2.8	2.7
1998	2.5	2.5	2.5
1999	3.0	3.0	3.0
2000	2.7	3.0	2.8

Table 4.

DUTCHMAN POND

SPRINGFIELD

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
DOCK				
	1998	6.38	6.38	6.38
EPILIMNION				
	1989	6.30	6.30	6.30
	1991	6.43	6.43	6.43
	1992	5.86	5.86	5.86
	1993	6.32	6.32	6.32
	1994	6.38	6.38	6.38
	1995	6.46	6.47	6.47
	1996	6.19	6.19	6.19
	1997	4.65	6.31	4.94
	1998	6.21	6.44	6.31
	1999	6.27	6.94	6.49
	2000	6.25	6.42	6.30
HYPOLIMNION				
	1989	6.37	6.37	6.37
	1992	5.66	5.66	5.66
	1995	6.42	6.48	6.46
	1997	6.65	6.65	6.65
	1999	6.70	6.70	6.70
	2000	6.30	6.49	6.38
METALIMNION				
	1997	6.49	6.49	6.49
	2000	6.47	6.47	6.47

Table 4.

DUTCHMAN POND

SPRINGFIELD

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
SOLEAU HOUSE				
	1998	6.33	6.33	6.33
SURFACE				
	2000	6.25	6.25	6.25

Table 5.

DUTCHMAN POND

SPRINGFIELD

Summary of current and historical Acid Neutralizing Capacity.
Values expressed in mg/L as CaCO .

Epilimnetic Values

Year	Minimum	Maximum	Mean
1989	1.80	1.80	1.80
1991	1.80	1.80	1.80
1992	2.10	2.10	2.10
1993	1.80	1.80	1.80
1994	1.90	1.90	1.90
1995	2.00	2.40	2.20
1996	2.10	2.10	2.10
1997	-1.10	1.60	0.25
1998	1.60	1.60	1.60
1999	0.90	1.70	1.30
2000	1.30	1.30	1.30

Table 6.

DUTCHMAN POND
SPRINGFIELD

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
DOCK				
	1998	23.8	23.8	23.8
EPILIMNION				
	1989	21.7	21.7	21.7
	1991	22.7	22.7	22.7
	1992	19.2	19.2	19.2
	1993	20.4	20.4	20.4
	1994	21.5	21.5	21.5
	1995	21.5	22.4	21.9
	1996	20.7	20.7	20.7
	1997	17.9	18.3	18.1
	1998	19.4	23.6	21.5
	1999	19.6	20.1	19.8
	2000	18.2	18.7	18.5
HYPOLIMNION				
	1989	21.9	21.9	21.9
	1992	19.2	19.2	19.2
	1995	21.3	22.6	22.1
	1997	18.6	18.6	18.6
	1999	19.6	19.6	19.6
	2000	18.2	19.0	18.6
METALIMNION				
	1997	18.6	18.6	18.6
	2000	18.1	18.1	18.1

Table 6.

DUTCHMAN POND
SPRINGFIELD

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
SOLEAU HOUSE				
	1998	23.9	23.9	23.9
SURFACE				
	2000	18.7	18.7	18.7

Table 8.

DUTCHMAN POND

SPRINGFIELD

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
EPILIMNION				
	1989	3	3	3
	1991	13	13	13
	1992	35	35	35
	1993	18	18	18
	1994	11	11	11
	1995	4	8	6
	1996	8	8	8
	1997	9	13	11
	1998	6	6	6
	1999	8	15	11
	2000	4	5	4
HYPOLIMNION				
	1989	5	5	5
	1992	6	6	6
	1995	5	9	7
	2000	4	4	4
METALIMNION				
	1997	16	16	16
	2000	17	17	17

Table 9.

DUTCHMAN POND

SPRINGFIELD

Current year dissolved oxygen and temperature data.

Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
		July 12, 2000	
0.1	21.0	8.3	93.3
0.5	21.0	8.2	92.2
1.0	20.8	8.4	93.5
1.5	20.8	8.4	94.2
2.0	20.9	8.5	95.0

Table 10.

DUTCHMAN POND

SPRINGFIELD

Historic Hypolimnetic dissolved oxygen and temperature data.

Date	Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
August 10, 1998	2.0	23.8	7.4	86.0

Table 11.

DUTCHMAN POND
SPRINGFIELD

Summary of current year and historic turbidity sampling.
Results in NTU's.

Station	Year	Minimum	Maximum	Mean
DOCK				
	1998	0.3	0.3	0.3
EPILIMNION				
	1995	1.0	1.0	1.0
	1997	0.1	0.5	0.3
	1998	0.2	0.7	0.4
	1999	0.2	0.3	0.2
	2000	0.3	0.4	0.3
HYPOLIMNION				
	1995	1.2	1.2	1.2
	1997	1.4	1.4	1.4
	1999	0.3	0.3	0.3
	2000	0.4	0.4	0.4
METALIMNION				
	1997	1.1	1.1	1.1
	2000	0.3	0.3	0.3
SOLEAU HOUSE				
	1998	0.3	0.3	0.3
SURFACE				
	2000	0.3	0.3	0.3

Table 12.

DUTCHMAN POND

SPRINGFIELD

Summary of current year bacteria sampling.
Results in counts per 100ml.

Location	Date	E. Coli See Note Below
G HOUSE		
	July 12	1

NOTE: "<" means "less than" and ">" means "greater than"